The Promises and Pitfalls of Technology in Higher Education

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A Vision of the 21st Century University

By

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To Dr. Robert W. House

Scholar, Mentor, Friend

“Imagination is more important than knowledge.
For knowledge is limited, whereas imagination embraces the entire world.”
—Albert Einstein

“If you can dream it, you can do it.”
—Walt Disney

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ACKNOWLEDGEMENTS

In the process of writing a book, one never knows where ideas or inspiration are going to come from. But, any book, in a sense, is a biography of the one who writes it, because it is a product of all of his or her experiences in life.

In writing a book about education, the biggest influences are always one's teachers, so I owe a debt of gratitude to many of the teachers I have had throughout my life. I will mention but a few here.

My mother and my sister both helped me throughout my life to be a better student of whatever subject I encountered—they encouraged me to examine my assumptions in the same way that I counsel others to examine theirs in the pages of this book.

Through high school, two teachers stand out, Mr. Blair for mathematics, and Miss Sprouse for English. Miss Sprouse is included here in Chapter Six as a tribute to her.

In college, and throughout my career, I have had the wise counsel of Dr. Robert House, who, at the time, was a Professor in the Engineering School at Vanderbilt, and who completed his career as Dean of the Graduate School there.

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PREFACE:
WHY EXAMINE WHAT TECHNOLOGY CAN DO FOR HIGHER EDUCATION?

"Education is the kindling of a flame, not the filling of a vessel."
—Socrates

A Personal Perspective

Remember your first day at university? I do—vividly. Amidst the cacophony of other stimuli (moving into the residence hall, meeting my dormitory-mates, navigating the campus, attending orientation sessions), I marveled at the opportunity the university offered. Looking at the buildings around campus (which, architecturally, were impressive, but not inordinately so), I was overwhelmed by the feeling that I, as a student, could freely walk into any one of those buildings and gain knowledge in *any* subject whatsoever. It wasn't the buildings, rather, but the knowledge of the people inside those buildings that made them so special. The feeling that a university offered almost infinite possibilities for learning still remains with me to this day, almost five decades after I first set foot on campus.

Furthermore, it has left me with the conviction that this is the feeling that a university *should* engender.

Since I did well in science and mathematics in high school, my teachers and guidance counselors advised me, "Perhaps you should go into engineering." So I did.

Freshman year being what it is, you don't really declare a major but you begin with a seed of an idea, which you water and fertilize with the courses and faculty you encounter.

But a lettuce seed won't sprout alfalfa, so there emerges an innate feeling of comfort or discomfort with one's academic choices that eventually brings either slight adjustments along the way or a full-on academic crisis.

Fortunately, my experience was the former, rather than the latter, guided by my wise advisor, Dr. Robert House, who later became the dean of the graduate school. Could an Artificial Intelligence program do a comparable job in guiding a student through the choices of his or her undergraduate

career? I wonder. We'll see an example of academic advising informed by Artificial Intelligence in Chapter Four, but, back to my story.

I started out in Electrical Engineering, incubated by the idea, mostly, that I wanted to know how radios worked. Yes, of course I know that even five decades ago there were much more advanced technologies than radios to be fascinated by, but I just could never get my head around the idea that an antenna, basically a metal "stick," could broadcast something into thin air, and that that signal could captured, with great fidelity, by an instrument that fit on a desktop. I suppose it was the "invisibility" of the technology that fascinated me—I longed to make the invisible visible in a practical way.

Another artifact of my high school education was the relative disdain I inferred from the teachers for courses like "Industrial Arts" for students who were taking an academic track to college, so I never took any of the "practical" courses in school that I later found might have benefitted me later.

This disdain for the practical seemed to manifest itself in college as well. The first Electrical Engineering course I took was a basic theoretical course on circuits. I was conflicted, because I was fascinated that you could use the tools of algebra and calculus to model the performance of RLC (Resistor, Inductor, Capacitor) circuits, including the fact that the imaginary number "*i*"[1] played a role in that analysis, but I was disappointed that it didn't bring me closer to an understanding of how a radio actually "worked." I understand that if you put the basic circuit elements together in this combination that it *does work*, but it didn't answer the *why* question for me adequately. Practically. Visibly. Intuitively. I suspect I am not the first or last university student who has had a longing to see academic subjects presented in this way.

I suppose this hunger for understanding the essence of things is the same feeling that physicists have when they learn Newton's Law of Gravitation but are still no closer to understanding exactly what gravity *is*, in contrast to how it manifests itself. If I understand my physics correctly, we are still no closer to an understanding of exactly what gravity *is*, other than the idea that it works by producing a warp in space-time. Or, more practically, it's the only game in town—at least in terms of forces that act at anything beyond a microscopic scale.

These and other experiences in and around universities have caused me to reflect over the years about what I would like the ideal university to be. And since most of my career since graduating has had something to do with

[1] $i = \sqrt{-1}$; Since square roots can only be taken for positive numbers, hence this number and versions of it are "imaginary." However, it is useful in calculating electrical impedance, among other uses in science and engineering.

advanced technology, my reflections on this subject have often involved some aspect of technology and the potential of technology to transform the university.

For me, the ideal learning environment would be a place where a student could be somewhat free to explore a broad, liberal education, learning from many fields,[2] while at the same time learning practical skills that would be useful in the employment marketplace. Perhaps this is too much to ask of a four-year institution, and financial and time constraints make it impractical to extend a bachelor's degree university education beyond four years. In fact, some universities, many of which are "for profit," advertise accelerated degree programs that enable adult learners to graduate within as few as two- and one-half years. Many traditional academics view such programs with skepticism. They consider "accelerated courses as being too compressed to produce consistent educational value. They perceive these courses as sacrificing breadth and depth, resulting in learning that is crammed and poorly developed."[3]

Such reflection brings us to ask the question, in essence, what is the "purpose" of a university—a question, we will find, that has been asked and explored since the founding of the University of Bologna, Europe's first university, in 1088.

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[2] William Deresiewicz, in his book *Excellent Sheep,* also seems to consider this the ideal, and bemoans the overachieving mentality of today's students in elite universities, a mentality which begins in early childhood, often fueled by ambitious parents.

> The whole of childhood and adolescence, across a large swath of society, is now constructed with a single goal in mind. All the values that once informed the way we raise our children—the cultivation of curiosity, the inculcation of character, the instillment of a sense of membership in one's community, the development of the capacity for democratic citizenship, let alone any emphasis on the pleasure and freedom of play, the part of childhood where you actually get to be a child—all these are gone. As the sociologist Mitchell L. Stevens has put it, 'affluent families fashion an entire way of life organized around the production of measurable virtue in children.' Measurable, here, means capable of showing up on a college application. We are not teaching to the test; we're living to it. William Deresiewicz. *Excellent Sheep: The Miseducation of the American Elite and the Way to a Meaningful Life*. New York, NY: Free Press, 2014, 49.

[3] Raymond J. Wlodkowski, "Accelerated Learning in Colleges and Universities," *New Directions for Adult and Continuing Education*, no. 97, (2003): 6.

The Purpose of a University

In addition to examining technology's role in the 21st Century University, this book will also frequently return to the theme of the university's greater purpose. A university can accomplish its mission without the introduction of advanced technology, but we are interested in the extent to which advanced technology might help or hinder the university in attaining its greater purpose.

Those who are among the community of scholars have an intuitive sense of what that purpose is, but to put it into precise words is problematic. We understand that among the university's core values are the notions of reasoned intellectual debate, academic freedom, and the freedom to explore controversial or dissenting ideas. The university's mission certainly also includes educating students, by helping them to mature intellectually and to prepare for their careers, but also to inculcate the values listed above and, hopefully, to give students the tools and inspiration to become life-long learners.

In that same vein, when I returned to the same university 20 years after earning my bachelor's degree to work on my doctorate, I became acquainted with Pascarella and Terenzini's seminal work, *How College Affects Students,*[4] and found it to be especially revelatory of students' experience at university—both what it *is* and what it *ought* to be.

Pascarella and Terenzini present college as a transformative experience, which it indeed is for many of us. Not only do we learn valuable information, but more than that, we learn to examine ourselves and our own beliefs. I highly recommend this book for those who have not yet read it, and I recommend re-reading it from time to time in order to appreciate the enormous impact that college can have on our lives, our beliefs, and our future. The careful reader of this book will note Pascarella and Terenzini's work reappear in the scenarios presented in Chapters Four through Seven. I have done this intentionally within the context of the narrative scenarios, because I believe it keeps us focused on the purpose of the university, irrespective of the technologies that are used in the service of the university's mission.

Rereading it myself as preparation for writing this book led me to an equally seminal work, William G. Perry, Jr.'s *Forms of Ethical and Intellectual Development in the College Years: A Scheme*. Perry's work preceded Pascarella and Terenzini by several decades, but it addresses similar themes—the transformative effect of higher education.

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[4] Ernest T. Pascarella and Patrick T Terenzini, *How College Affects Students, Vol. 2*. (San Francisco, CA: Jossey-Bass, 2005).

Through annual interviews with Harvard and Radcliffe students, Perry's 1960's-era book shows how college is, for some, an intense period of intellectual and ethical awakening. Though we matriculate at university as freshmen, we are all mostly "sophomores" in the sense of the word that connotes intellectual immaturity and naiveté; and although some students progress more quickly than others, some remain essentially *sophomores* throughout their entire college experience. Perry explains this logic:

> Not all students are "sophomores," in this sense, in their sophomore year. Some come to college as "juniors" or even "seniors." Some go all the way through college and somehow manage to remain schoolboys to the end. In the sense in which we are speaking, indeed, many people achieve the consequences of a college education without ever going to college at all. The function of a college, however, is to present to the students' attention in concentrated form all the questions that the sophomore in man has raised for himself through the ages and which he has spent the rest of his history trying to resolve, rephrase, or learn to live with.[5]

I love this phrase: "The function of a college is to present to the students' attention in concentrated form all the questions that the sophomore in man has raised for himself through the ages." Isn't this *a core component* of what a university experience should be, if not *the core component*, on par with imparting content knowledge? It is the assumption of this book that it is a core component, and to the extent that technology helps to serve this end, that technology is useful. Correspondingly, to the extent that a technology does not promote this end, the university should be wary of its use.

Ways in Which Our Universities Have Succeeded and Failed to Live Up to the Vision

This notion of the larger purpose of higher education is equally emphasized in other recent authoritative works, such as Derek Bok's *Our Underachieving Colleges,* Harold Shapiro's *A Larger Sense of Purpose*, and Anthony Kronman's *Education's End: Why Our Colleges and Universities Have Given Up on the Meaning of Life*, written by authors who should know.[6] These books are equally seminal in helping to explore the "function" or purpose of a university and inform this present work as well.

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[5] William G. Perry, Jr., *Forms of Ethical and Intellectual Development in the College Years* (San Francisco, CA: Jossey-Bass, 1999), 37.

[6] Derek Bok is president emeritus of Harvard University; Shapiro is president emeritus of both the University of Michigan and Princeton; Kronman is the former dean of Yale Law School: Derek Bok, *Our Underachieving Colleges* (Princeton, NJ:

This book aims to examine how the 21st Century University can better fulfill its higher purpose while also fulfilling the need to impart content knowledge in order to prepare graduates for their future occupations, whether in academia, government, industry, or elsewhere. A central element of this work is to examine the role of technology in that endeavor. In brief, modern technology offers a tremendous opportunity for improving the ability of the university to accomplish both ends, but it is not without its potential negative effects as well. Introducing the breakthrough technologies of the 21st Century will engender both *promise* and *pitfalls.* We should embrace the *promise*, and, in the intervening years from now until many of these technologies are embedded in our universities, learn to avoid, or at least minimize, the *pitfalls.*

Growing from Sophomore to Intellectual Adulthood

But, before proceeding to the main story, let us return to the story of the maturing college student to see what we can expect from him (or her) as he/she matures intellectually, and then begin to imagine how we might be able to influence that maturation process in the future.

Perry illustrates how such an intellectual *sophomore* emerges from his awakening:

> Man is distinguished from the ape not by his reason, at which the ape is often no slouch, but by his meta-reason, which is a blessing with which the ape is presumably uncursed. The characteristic of the liberal arts education today…is its demand for a sophistication about one's own line of reasoning as contrasted with other possible lines of reasoning. In short, it demands meta-thinking. William James would hold that there is nothing useful or good about a meta-thought unless it has useful consequences for an action…[lest] Meta-meta-thoughts become 'higher' than meta-thoughts, and meta-meta-meta thoughts higher yet, *per astra ad absurdum…*[But] It is not this tendency that causes the sophomore his pain, even though, when first the floodgates let go, he gets lost in just this way. The issue at hand, we think our records show, is responsibility. If all I have been taught up to now is open to question, especially to *my* question, then my sense of who is responsible shifts radically from outside to me.[7]

Princeton University Press, 2006); Harold T. Shapiro, *A Larger Sense of Purpose: Higher Education and Society* (Princeton, NJ: Princeton University Press, 2005); Anthony T. Kronman,. *Education's End: Why Our Colleges and Universities Have Given Up on the Meaning of Life* (New Haven, CT: Yale University Press, 2007).

[7] Perry, *Forms of Ethical and Intellectual Development,* 37.

The point of intellectual maturity has been reached! The heretofore *sophomore* has come to the realization that having been equipped with the tools of intellectual inquiry, it is now up to him (or her) to use those tools to make his own enquiries and conclusions about the questions "he has raised for himself through the ages." He (she) is also presumably equipped with the content knowledge to enable him to perform in a chosen profession.

Yet, some university students resist this intellectual maturing aspect of higher education. Why is this so? Higher education research has not yet revealed why this is the case,[8] but it is not a recent phenomenon. In a study of the influence of higher education on emotional and intellectual maturity that antedates both that of William Perry and Pascarella and Terenzini, we find the following passage:

> Some students have a set of mind so rigid, an outlook on human relations so stereotyped and a reliance on authority so compulsive that they are intellectually and emotionally incapable of understanding new ideas, and seeing, much less accepting, educational implications which run counter to their pre-conceptions. This particularly limits their responsiveness in the social sciences and the humanities whenever controversial issues arise. Such students quail in the presence of conflict and uncertainty. They crave "right answers." They distrust speculative thought, their own or their fellow students.' They recoil from "creative discussion."[9]

To me, the previous quoted passages are disturbing. If I am a matriculating university student, no matter how well my family, my secondary school, or my church has prepared me—if I am honest, I have to admit that I have much to learn, particularly when I realize that I am among scholars who have spent their entire lives inquiring about a particular subject of concern. If I find the same bent of mind among several of these individuals, it should stimulate me to pause and inquire of myself if I have, perhaps, made some conclusions in my young life that might be enlarged by critical examination of differing points of view. If am only concerned with a right answer, or

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[8] For some examples of research in this field, see Arend, Bridget, Beth Archer-Kuhn, Kazuko Hiramatsu, Christopher Ostrowdun, Janel Seeley, and Adrian Jones, "Minding the Gap: Comparing Student and Instructor Experiences with Critical Reflection," *Teaching & Learning Inquiry* 9, no. 1 (2021): 317-332; Jan Fook, Val Collington, Fiona Ross, Gillian Ruch, and Linden West, *Researching Critical Reflection: Multidisciplinary Perspectives* (Abingdon, Oxon: Routledge, 2016); and Roger J. Cacchiotti, "A study in fostering student engagement through guided developmental critical reflection skills and critical thinking skills." (PhD dissertation, Capella University, 2011).

[9] Philip E. Jacob, *Changing Values in College: An Exploratory Study of the Impact of College Teaching* (New York, NY: Harper & Brothers Publishers, 1957), 10.

worse, with having my own immature preconceptions confirmed in the university environment, then I may be wasting my time and the time and talents of those at the university.

I have approached this book with the presumption that most university students are eager to learn, to explore ideas, and to have their preconceptions tested and challenged. So, as a student, what should I expect from a university—what should the outcomes be, and what mindset must I approach higher education from in order to make the most of my investment of time and money?

Three Desired Outcomes of a Higher Education

If the university has prepared me to be a functioning *enquirer*, then it has done three things. First, it has made me aware that my naïve belief that there exist right and wrong answers available for *everything* is itself in error; second, that although subject matter content knowledge is important, and that I should spend time preparing myself in that area, *it is not enough*; and third, that the synthesis of ideas, knowledge, and its implications is *up to me*—not some expert who will spoon-feed me the right answers. If I have understood this, then I have become an intellectual adult.[10] Upon graduation, I am equipped to engage ideas on my own terms, and furthermore, I understand the importance of being a life-long learner. In some cases, this will lead me to further traditional intellectual pursuits through graduate school and the like, in other cases, it will prompt me to investigate on my own—as a self-learner.

These are things that everyone should expect from a higher education institution. Now, since technology is one of the main emphases of this work, we must begin to address the next obvious question.

[10] To this list, William Deresiewicz would likely add a fourth desired outcome—self-knowledge. He explains, "Self-knowledge is the most practical thing in the world, because it helps you find your way to a career that's right for you. 'What is the meaning of life?' may be the stereotypical philosophical question, supposedly abstract and pointless, but it bares its teeth when you phrase it like this: 'What is the meaning of *my* life?' That is not a question that you want to wake up asking when you're forty." William Deresiewicz, *Excellent Sheep: The Miseducation of the American Elite and the Way to a Meaningful Life* (New York, NY: Free Press, 2014), 89.

How Will Advanced Technology Help?

None of the things that we have talked about above are unique to advanced technology. An intellectual *sophomore* can progress to intellectual adulthood by sitting at the feet of Socrates—in Chapter 1 we embrace Socrates as the father of the method of intellectual enquiry—or by sitting at his *virtual feet* in a virtual hologram room created by virtual reality that is connected to every book or video ever created, and accessible by artificial intelligence search algorithms—Google on steroids, so to speak. But an intellectual *sophomore* determined to remain so can fail to be moved by either of these environments. A determined, growing intellectual mind will embrace either environment and make the most of it. But the technologically-enhanced environment offers so much for the intellectual aspirant of the future—access to content, to experts, to virtual-experimentation and analysis that make our intellectual forebears green with envy. "You mean you literally have access to all the world's knowledge at your fingertips?" Socrates might ask—or perhaps it would be Francis Bacon, or the French Encyclopedists[11]—that was also their dream and aspiration.

The university of the future may not have "all the world's knowledge at our fingertips," but it will be closer to that dream than ever before. Already so much knowledge and information is available online as to make it impossible to ever view it all, much less master it. We will find, and are finding now, how important the tools of *intellectual maturity and critical thinking* in an online world replete with misinformation, propaganda, and downright lies are. A mature intellectual knows how to navigate this minefield. The intellectual *sophomore* is more likely to be ensnared by it. So, it is now more important than ever that we prepare students for this information profusion.

Beyond access to information, we find that technology offers us information about ourselves that, in mature hands, can help us to be better people, and more thorough scholars. But the pitfall here is that, in examining ourselves, we may find things we do not like about ourselves, and even despair about it. Our artificial-intelligence-enabled computer may, in the future, steer us into certain fields of study based on its assessment of our interests and intellectual acuity—much in the same way that my high school

[11] Bacon's seventeenth-century work, *Novum Organum* or *The New Organon,* was an attempt to propose a new method of investigating nature and reality—a revolutionary method of inquiry that presaged the scientific method. The Encyclopedists were an eighteenth-century group of French Enlightenment scholars, of whom the best known was Denis Diderot, who aimed to codify all the knowledge of the world into a set of encyclopedias and to make this information available to the masses.

guidance counselors steered me toward a career in engineering. But, imagine if your dream is to become a doctor, or a lawyer, or an engineer—and a faulty, or even accurate Artificial Intelligence program deflates your balloon by informing you that you lack the intellectual or emotional capacity to enter such a profession and be successful?

Another potential pitfall is privacy. We surrender more and more of our privacy to technology every day. We make purchases online, where we hope that our credit card information and Social Security numbers are secure. We permit certain apps on our Smartphones to track our position. We reveal much information about ourselves on social networking sites—sometimes information that can be harmful to us or harm our careers. It is likely that future technology will become even more intrusive. We may wear fitness watches, fitness bands, advanced sensors that monitor our sleep and movement patterns. We may become aware that drones and other surveillance technologies make it difficult to "fade away" even if we want to get "off the grid," even for a brief time.

Robots, Artificial Intelligence, and other technologies will begin to do more and more of our work for us—ideally freeing us for more esoteric or creative pursuits, but which ones? The fear that I will become obsolete will become a growing fear in the future. Am I useful, or can an advanced robot with an advanced Artificial Intelligence program do everything that I have worked so hard to learn how to do?

But it is not all bad. Examining ourselves and our career choices with the aid of an AI program may make us happier in the long term. Being aware of our nutrition, exercise, and sleep based on AI and sensor observation may make us healthier both mentally and physically. And freeing ourselves from repetitive tasks for more creative outlets has been the dream of philosophers and intellectuals for centuries. Now that we are sitting on the cusp of this revolution, it is important for us to examine the implication of this. That, and to examine ourselves.

A Note about How Quickly Technology Progresses and How Easy it is to Underestimate

We live in an age where technological progress truly moves at lightning speed. A computer purchased today may be obsolete in three to five years.[12]

[12] Derek Walter, "How Long Do Computers Last? 10 Signs You Need a New One," *Business News Daily*, December 17, 2021, https://www.businessnewsdaily.com/65-when-to-replace-the-company-computers.html. (accessed December 1, 2022).

Higher education and business websites opine about the half-life of a university degree,[13] particularly in technical fields.

Intel Corporation Co-Founder Gordon Moore developed his "Law" in 1965, which, briefly stated, predicts that the ability to place transistors onto integrated circuits would double every two years.[14] Moore initially thought his law might only hold true for ten years, but it has held true, or nearly true for almost 60 years now. Cell phones have replaced land-line phones in many households in the United States, and, in the developing world, people own cell phones who never had a phone their homes.

Notwithstanding Moore's Law, even some of our foremost technological experts are poor at assessing the speed and depth of technological revolutions. Ken Olsen, founder of Digital Equipment Corporation, is quoted as saying (in 1977) that "There is no reason anyone would want a computer in their home,"[15] and IBM founder Thomas Watson, in 1943, predicted a world market for "maybe five computers."[16] These statements seem amusing now, but they are a testimony to the rapidly changing nature and perception of technology, even by its own creators. It grows to meet a need, but it sometimes also creates needs of its own. As another technology pioneer, Steve Jobs, once said, "People don't know what they want until you show it to them."[17]

The consumer market for technology will grow in the future, fueled both by need and by the new possibilities that are opened by technology that consumers do not yet know that they need. New inventions will fuel a new round of technology consumerism. Some of this will doubtlessly find its way into the academy.

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[13] Thomas Frey,. "The Half-Life of a College Education." *Futurist Speaker,* March 1, 2013, https://futuristspeaker.com/business-trends/the-half-life-of-a-college-education/ (accessed September 10, 2022); See also Samuel Arbesman, *The Half-Life of Facts: Why Everything We Know Has an Expiration Date* (New York, NY: Penguin Group, 2013).

[14] Gordon E. Moore, "Cramming More Components onto Integrated Circuits," *Electronics* 38, no. 8 (April 19, 1965): 1-4.

[15] Robert Strohmeyer, "The 7 Worst Tech Predictions of All Time," *PCWorld,* December 31, 2008, https://www.pcworld.com/article/532605/worst_tech_predictions.html (accessed August 17, 2022).

[16] Strohmeyer. "The 7 Worst Tech Predictions of All Time."

[17] Jason Aten, "This Is Steve Jobs's Most Controversial Legacy. It is Also His Most Brilliant. When you should listen to your customers," *Inc.* January 19, 2021, https://www.inc.com/jason-aten/this-was-steve-jobs-most-controversial-legacy-it-was-also-his-most-brilliant.html (accessed August 17, 2022).

The value of this work is to look, briefly, into the future—"through a glass darkly"—and to imagine what technology might be able to offer to higher education in the future. It will help us to chart a course to achieve part of that dream. But we will also need to keep in mind the purposes of the university to ensure that those technologies assist rather than dominate that future.

A Time Machine?

Chapter Four's dialogue includes a joke about a time machine. This is intentional to force us to focus on the question of time travel. Though physicists often tell us that physical time travel is likely impossible, there is a kind of time travel that is possible for us, and quite useful. First, we can examine the past through the written word, and, more often now, through audio and video recordings of past events. Future Artificial Intelligence technology will enable us to peer into even more detail about the past, and to theoretically examine the possible consequences of different decisions (counterfactuals), or to peer into the minds of the decision-makers of the past. Historians have done this sort of thing for centuries, but now with the aid of AI, they may be able to integrate *every single historical source* into their analyses. AI may also aid in the psychological examination of past leaders, to theorize about what hidden factors may have influenced their decision-making. Interactive Virtual Reality and holographic tools may make it possible for us to virtually attend historical events.[18] Would it be more educational for a student to virtually attend Winston Churchill's famous "Iron Curtain" speech rather than just reading about it?[19] That is an important question—no answer is offered to it here—but it would be enlightening. And fun.

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[18] "Think of the happiness of the scholar if he could see a Greek republic or a Roman colony actually living under his own eyes granted that he recover from the havoc of some of his best-established delusions!" Abraham Flexner, *Universities: American, English, German* (New York, NY: Oxford University Press, 1930), 12, quoting Salvador de Madariaga, *Aims and Methods of a Chair of Spanish Studies.* (London, UK: Clarendon Press, Oxford, 1928).

[19] You can watch Churchill's famous speech now on YouTube at https://www.youtube.com/watch?v=ZA5ISi9yhhs. In the future, with the help of Artificial Intelligence and virtual reality, it may be possible for you to *attend* this event, absorbing more of the sights, sounds, smell, and crowd reaction at the event.

For the future, until space travel near the speed of light or human hypersleep[20] becomes a possibility, we may approach travel to the future only in a virtual sense. Science fiction has offered us this option for years, traveling there in our imagination, but of what academic value is *virtual* time travel to the future? Once again, we have AI to thank. Artificial Intelligence, and, in particular, *Predictive Analytics* will enable us to more accurately predict the future. We will be able to predict where the technology is going, as Gordon Moore did so accurately with his "Law." We will be able to predict the effects of these technologies more accurately, along with envisioning the possible negative side-effects. Imagine if we had been able to anticipate the negative effects of coal-based power production one hundred years ago? It is almost certain that we still would have continued to use coal for a time, but the likelihood that the transition to clean and sustainable power might have come much more rapidly.

In the future, we will also be able to use AI to test various options in response to future political and natural crises so that we may be best prepared for the future, whatever it presents to us.

With all this capability, there are no guarantees. The future will continue to surprise us as much as it always has, but by making these kinds of things a part of the future of higher education will guarantee that we produce experts and leaders who are more prepared to address whatever crisis presents itself.

A Vision and a Warning

We already know that technology connects us with a much wider universe of content knowledge—whether inside or outside the university. I can buy or rent my textbooks on Kindle, I can access my library and research databases through my computer or even my phone. I can view tutorial videos or even entire lectures on YouTube or Khan Academy; I can enroll in MOOCs—Massively Open Online Courses.[21] I can connect with other students at my university or other universities through social media. I can register for (and often attend) my classes online. I can communicate with my advisor and my professors through email and perhaps even have electronic meetings with them on Zoom or Teams forums. Technology has

[20] Fraser Cain, "Is human hibernation possible? Going to sleep for long duration spaceflight," *Phys.org*, June 22, 2017. https://phys.org/news/2017-06-human-hibernation-duration-spaceflight.html (accessed November 25, 2022).

[21] For more on MOOCs, see "Disruptive Technology: Education" *Herron (blog)*, March 1, 2019, https://herron-co.com/blog/2019/03/disruptive-technology-education (accessed December 1, 2022).

already made it possible for me to do some of the things envisioned for the 21st Century University that can improve my university experience now.

Yet there are limitations. If you lived in a dormitory at any time during your own college years, consider the impact of the following passage from Perry's work:

> In our records, the confrontation with pluralism occurs most powerfully in the dormitory. Here diversity emerges within the in-group with a starkness unassimilable to the assumptions of [an intellectually immature student]…by any rationalizations whatever. The accommodations of structure forced by this confrontation make possible a more rapid and clear perception of pluralism in the curriculum.[22]

Those "confrontations" were neither structured nor planned. They were the result of diverse individuals thrust into an environment where their diversity in background, thoughts, ideas, preparation, opinions, biases, and prejudices were subject to scrutiny by all the rest of the students occupying the same residential space. Even in institutions where the student body was somewhat demographically homogeneous (e.g., military academies, non-coeducational schools, some religious-affiliated schools), these differences in thoughts, ideas, and attitudes are still likely to be there—albeit buried below the surface in some cases.

As university students, we wake up at different times, go off to classes at different times, eat at irregular intervals, and run into our schoolmates at all hours of the day and evening. Debate on ideas takes on an "ad hoc" quality, sometimes spurred by something that was happening at the school or society, other times, just due to some student's desire to engage in spirited conversation with another schoolmate. Those of us who experienced college in this way look back on it as an important formative time of our intellect and personalities. It is often the reason we look forward to going to reunions, or want to follow our school's sports teams. How do you duplicate this in an entirely online environment? You can't, at least not completely. Something is lost when technology tries to replace this aspect of a university education.

This aspect—daily contact with schoolmates and faculty who think differently from you—is one of many aspects that defines college as something much more than the accumulation of content knowledge, which we acknowledge is important in and of itself, and as a component of intellectual maturity, but,

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[22] Perry, *Forms of Ethical and Intellectual Development,* 77.

> The difference is surely not simply the "content" of so many courses in Chemistry or History. Anti-intellectuals have been known to master mountains of data and technology. The anti-intellectual cannot be passed off as one who refuses to think. Many think dangerously well. Similarly, the liberally educated man cannot be caricatured as one who sees so many sides of a subject that he cannot act. Our records belie such stereotypes.
>
> We have come to believe from all these hours of listening that the anti-intellectual, be he in or out of college, is definable not as "against thinking," but against thinking about one particular thing: thought. Most particularly his *own* thought.
>
> In contrast, the liberally educated man, be he a graduate of college or not, is one who has learned to think about even his own thoughts, to examine the way he orders his data and the assumptions he is making, and to compare these with other thoughts that other men might have. If he has gone the whole way, as most of our students have done, he has realized that he thinks this way not because his teachers ask him to but because this is how the world "really is," this is man's present relation to the universe. From this position he can take responsibility for his own stand and negotiate—with respect—with other men.[23]

This last point is crucial, and points to another potential danger with technology. These days, there is a profusion of data available on the Internet, social media, television, and other media, all competing for our attention and the imprimatur of "truth." One side decries the other's truth as "fake news," and vice versa. College should prepare us to some degree to discriminate between "real" and "fake" news and data, but the sheer volume that is available to us today, without an impartial referee to help us, makes that judgment more difficult than before. We must become wiser consumers of information if we are to navigate this morass, and both college and technology must help us in this effort.

To wit, consider the current debate on global climate change. NASA reports that greater than 97 percent of actively publishing climate scientists "agree that humans are causing global warming and climate change. Most of the leading science organizations around the world have issued public statements expressing this, including international and U.S. science academies, the United Nations Intergovernmental Panel on Climate Change, and a whole host of reputable scientific bodies around the world."[24]

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[23] Perry, *Forms of Ethical and Intellectual Development,* 44.

[24] "Do Scientists Agree on Climate Change," *Global Climate Change, NASA*, November 22, 2022, https://climate.nasa.gov/faq/17/do-scientists-agree-on-climate-change (accessed December 1, 2022).

This overwhelming consensus of the experts should end the debate for a mature intellectual. In contrast, a debate about the differential effectiveness of fiscal vs. monetary policy in economics is much less consensual.[25] A mature intellectual is at liberty to weigh in on either side of such a debate, armed, of course, with data to back up that position.

Are we able to examine the scientific consensus of opinion before stepping into a debate that is futile? Does technology help us in this endeavor, or does the fact that there are voices on the Internet or talk radio that voice an opinion in a loud voice make it worth our time to listen? Is "flat earth" theory a fitting subject for college graduates to debate? Creation science? The efficacy and risks of COVID-19 vaccines? These days, these subjects of "settled science" seem to stimulate as much debate as a debate over the merits of fiscal stimulus—even more so in many cases. The 21st Century University should help us avoid these matters of intellectual folly and concentrate on the debates that matter—and that are truly worthy of debate. COVID-19 vaccines became widely available in the United States around April 2021. Yet, as of the time this writing, there have been more than half a million COVID-19 deaths in the United States since that—the majority of which could have been prevented if not for widespread misinformation spread *through technology*.[26]

Technology can be very useful in the realization of the 21st Century University, and we aim to focus on the ways in which technology can be a valuable part of that. But we must never forget that technology can have negative consequences as well. In the ancient myth, Prometheus stole fire from the gods and gave it to humanity. This primeval diffusion of technology has mostly been good for humankind, though it did not turn out very well for Prometheus himself in the end. But even fire has manifested itself in negative ways as well, particularly when handled in a cavalier fashion, resulting in things like wildfires in our forests and in the production of weapons of war, in finding more ingenious ways to kill one another rather than build one another up.

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[25] This lack of economic policy consensus is said to have exasperated President Harry Truman so much that he exclaimed, "Give me a one-handed economist! All my economists say 'on the one hand [and then] on the other." "Why One-Handed," *The One-Handed Economist,* https://one-handed-economist.com/?page_id=46 (accessed October 29, 2021).

[26] COVID-19 Data Sources: covid.cdc.gov and www.everydayhealth.com (both accessed October 29, 2021).

Let us learn the lesson from Prometheus and handle any new technology with care.[27] Let us also keep that lesson in mind as we examine the potential for technology in higher education.

[27] One of the first books I ever encountered on this subject in college was Emil Joseph Piel, *Technology: Handle with Care* (New York, NY: McGraw-Hill, 1975), which is now out of print. As I recall, this book addressed the possible negative consequences of technology in a practical and uncomplicated manner. Examination of the ethical and societal consequences of technology is a subject that, sadly, is not sufficiently addressed in many engineering school curricula today, displaced by the addition of more core requirements. Core requirements *are necessary*, but so are courses about ethics and societal consequences of technology.